## Matter (Physical Science Unifying Concept A)

**Matter has various states with unique properties that can be used as a basis for organization. The relationship between the properties of matter and its structure is an essential component of study in the physical sciences. The understanding of matter and its properties leads to practical applications, such as the capability to liberate elements from ore, create new drugs, manipulate the structure of genes and synthesize polymers.**

| By the end of the grade band: | By the end of the grade band, students know and are able to do everything required in earlier grades and: | By the end of grade band, students know and are able to do everything required in earlier grades and: | By the end of grade band, students know and are able to do everything required in earlier grades and: | |
|---|---|---|---|---|
| **Grades K - 2** | **Grades 3 - 5** | **Grades 6 - 8** | **Grades 9 - 12** | |
| **P.2.A** **Students understand that matter has observable properties.** | **P.5.A** **Students understand properties of objects and materials.** | **P.8.A** **Students understand the properties and changes of properties in matter.** | **P.12.A** **Students understand that atomic structure explains the properties and behavior of matter.** | |
| P.2.A.1 Students know matter can exist as solids and as liquids. E/S | P.5.A.1 Students know matter exists in different states (i.e., solid, liquid, gas) which have distinct physical properties. E/S | P.8.A.1 Students know particles are arranged differently in solids, liquids, and gases of the same substance. E/S | P.12.A.1 Students know different molecular arrangements and motions account for the different physical properties of solids, liquids, and gases. E/S | **Properties of Matter** |
| P.2.A.2 Students know some properties of materials can be changed by heating, freezing, mixing, cutting, or bending. E/S | P.5.A.2 Students know heating or cooling can change some common materials, such as water, from one state to another. E/S | | | |
| P.2.A.3 Students know matter can be categorized by observable properties, such as color, size, shape, and weight. E/S | P.5.A.3 Students know materials can be classified by their observable physical and chemical properties (e.g., magnetism, conductivity, density, and solubility). E/S | P.8.A.2 Students know elements can be arranged in the periodic table which shows repeating patterns that group elements with similar properties. E/S | P.12.A.2 Students know elements in the periodic table are arranged into groups and periods by repeating patterns and relationships. E/S | |
| P.2.A.4 Students know different objects are made of many different types of materials. E/S | P.5.A.4 Students know that, by combining two or more materials, the properties of that material can be different from the original materials. E/S | P.8.A.3 Students know methods for separating mixtures based on the properties of the components. E/S | P.12.A.3 Students know identifiable properties can be used to separate mixtures. E/S | **Mixtures and Compounds** |
| | | | P.12.A.4 Students know atoms bond with one another by transferring or sharing electrons. E/S | |
| | | P.8.A.4 Students know atoms often combine to form molecules, and that compounds form when two or more different kinds of atoms chemically bond. E/S | P.12.A.5 Students know chemical reactions can take place at different rates, depending on a variety of factors (i.e. temperature, concentration, surface area, and agitation). E/S | |
| | | | P.12.A.6 Students know chemical reactions either release or absorb energy. E/S | |
| | P.5.A.5 Students know the mass of a material remains constant whether it is together, in parts, or in a different state. E/S | P.8.A.5 Students know mass is conserved in physical and chemical changes. E/S | P.12.A.7 Students know that, in chemical reactions, elements combine in predictable ratios, and the numbers of atoms of each element do not change. I/S | |
| | P.5.A.6 Students know materials are composed of parts that are too small to be seen without magnification. E/S | P.8.A.6 Students know matter is made up of tiny particles called atoms. E/S | P.12.A.8 Students know most elements have two or more isotopes, some of which have practical applications. I/S | **Atomic Structure** |
| | | P.8.A.7 Students know the characteristics of electrons, protons, and neutrons. E/S | P.12.A.9 Students know the number of electrons in an atom determines whether the atom is electrically neutral or an ion. I/S | |
| | | P.8.A.8 Students know substances containing only one kind of atom are elements which cannot be broken into smaller pieces by normal laboratory processes. E/S | | |